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UNITED STATES DEPARTMENT OF AGRICULTURE • Economic Research Service

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AGRICULTURAL ECONOMICS RESEARCH
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Necessary Conditions for Growth of the Farm Business Firm[1]

By Warren R. Bailey

FARM PRODUCTION economists until recently devoted most of their research to the problem of resource allocation and efficiency, almost totally neglecting the economics of growth of the farm firm. The chief resources--land and, to a lesser degree, machines and labor force--were considered limited or fixed in amount. The fixed resources had to be allocated to various production enterprises so as to maximize net revenue to the firm. The highest-profit combination usually had to include some low-return, land-using enterprises. Often it included some livestock feeding enterprises in which the average return to capital traditionally has been lower than in crop enterprises. If resources were less fixed, the farm firm might include only the higher-return crop enterprises, a matter of importance to growth.

Until recently, farming was typically a "do-it-yourself" industry. Each farmer grew his own horsepower and the "fuel" to feed it. He provided the soil nutrients and the necessary human labor, and he owned the machines to perform almost every crop and livestock operation. In such circumstances, the allocation of mostly fixed resources among productive enterprises was exceedingly important. Many of the resources, e.g., family labor, had no other ready employment. Today, so many of the production (resource) services can be custom hired that resource allocation is less critical. Allocative analyses now serve chiefly to identify the restrictive resources so they can be augmented.

Another possible reason for neglect of farm growth research flows from historical accident. Farms in the older farming regions (Midwest and South) remained large enough in terms of acres to fully occupy the family labor, at least in crop farming. Any opportunities for growth of the firm were mainly in livestock feeding that could use the otherwise idle winter labor.

Research related to the farm firm has been confined to existing resources partly because not every farmer would be able to acquire additional land. Research has dealt with actions considered to be within the power of most operators, hence with solutions having general applicability. The apparent incongruity of generally needed adjustments in the presence of an assumed initial state of general equilibrium was largely overlooked.

Whatever the rationale, we may observe that some farm firms do grow in size. The question of growth can no longer be ignored. In fact, the economics of growth and of financial management necessary for growth are highly promising areas for research. Moreover, the answers we get to the old familiar resource allocation problems may turn out to be different when analyzed in a setting of growth.

Economics of Firm Growth

The economics of firm growth is easier to understand if we compare and contrast it with conventional static economic analysis. But first let us define what we mean by growth.

We mean an increase in the volume of business accompanied by an increase in inputs. Thus, rate of growth can be measured in units of production or sales, or in the associated units of resource inputs. We are not concerned here with growth arising solely from a more efficient use of the same stock of resources.

[1] Revision of a paper presented at a meeting of the Farm Management Research Committee, Western Agricultural Research Council, Portland, Ore., Nov. 2-4, 1965.

Nor are we concerned with an increase in net worth. Both can occur in a static firm.

In static economic analysis the focus is on long-term optimum allocation of limited resources which remain the same in total amount over time. Financing is seldom considered a problem because projected net returns are the basis of borrowing and of financial solvency. Nor is the analysis concerned with the disposal or reinvestment of managerial earnings or profits. The static firm in maximizing net returns must usually engage in some lower return enterprises, either extensive (e.g. beef raising) or intensive (e.g. beef fattening).

In dynamic analysis of firm growth, no production resources are considered fixed. From an assumed starting state, the firm over time acquires additional resources financed out of annual income and by borrowing. For growth to occur, the starting state must provide a surplus of cash returns over farm and family living expenses unless the firm has equities available for borrowing, or is subsidized. The firm may include significant nonfarm activities at the start. In fact, nonfarm employment of the operator or his wife could be the chief source of new capital in the early stages of growth. Returns need not cover depreciation or a return to owned equity in the short run. Thus, a firm may operate at what would be a long-term net loss, but cover its direct costs and achieve growth in the short run. Rate of growth is maximized when net cash return is maximized in the short run. Financial management strategies are the core of the growth problem. Because no resources are fixed, both the starting and the growth resources can be allocated to high-return enterprises.

This may explain why farmers in the Great Plains generally have not engaged in farm feeding of livestock. They have preferred, understandably, to expand the grain enterprise in which rates of return to capital and labor were higher.

If growth is to occur, selection of (highest return) enterprises must be such as to maximize the funds available for reinvestment. Strategies used in procuring the services of production resources also affect the rate of firm growth. The basic strategy--other things being equal--is to minimize the short-run cost per unit of production services, one production period at a time. (In static analysis the strategy would be to minimize the cost per unit in the long run.) The services of production resources can be acquired basically in three ways: By outright ownership, by renting, or by custom hiring. These methods differ as to quantity (units) of production services obtained with the same outlay in the short run. However, the firm earns an entrepreneurial return--marginal value product minus marginal cost--from employing the production resource, whatever the method of procurement. That is, ownership is not necessary.[2]

Let us consider an example in which the resource is wheatland valued at $60 an acre, the annual product is $16, share-rent is one-fourth of the crop, annual charges for taxes, insurance, and depreciation are 37 cents an acre, and the mortgage terms are a fifth down with the balance amortized in 30 years at 5.5 percent interest.

In acquiring ownership the firm buys all future production services of the land, not only for the year ahead but for all future years. With a cash purchase, $1,000 would "buy" the production services of about 17 acres not for one year but forever.

If the purchase is with a mortgage, $1,000 would buy the production services of 64 acres of land the first year, after which the annual charge would be about $235 on the 64 acres. With mortgage purchase, the opportunity for growth is greater than with cash purchase but not as great as with renting.

If the land is crop-share rented, $1,000 would buy the production services of 250 acres for one year. Although share rent usually exceeds the annual amortization payment, renting avoids the initial downpayment of mortgage buying. However, if there is no downpayment, or only a small one, the amortization payment may exceed the annual crop-share rent. For example, the annual payment is $4.46 an acre on a full loan of $60 at 5.5-percent interest for 30 years, and $5.02 for a loan repaid in 20 years; it is $4.02 an acre on a loan of $48 for 20 years.

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[2] In buying land the farmer assumes the function of a landlord, accepting the same contractual return as any nonoperating owner. The decision as to ownership is not an entrepreneurial function.

In the illustration later in this paper, the firm rents all its land, and does not own a grain combine until the fifth year of operation.

We are now ready to list and discuss the conditions necessary for growth of the firm.

Necessary Conditions

Excess managerial capacity.--An obvious and yet easily overlooked condition necessary for growth of the farm business firm is that the operator have a surplus of capacity for management. He must be willing and able to take on the duties of a larger farm business. Growth does not demand superiority in management but it does require additional reserve capacity. Most young farmers probably have a surplus of managerial capacity. That is, they can manage more land and other resources than they can get control of. Managerial capacity is often one of the resources not in balance in a business firm, rendering it in disequilibrium which is a necessary condition of firm growth.

Profitableness of the business.--Another necessary condition is that the farming enterprises undertaken must be profitable. Cash receipts on the average must exceed cash expenses. The firm need not be the most efficient firm in an area or group, nor even highly efficient. We are not saying that the farm with the highest profit ratio is most likely to grow, or to grow the fastest. Growth is a matter of managerial objective and is subject to particular reinvestment strategies. Some may say that a farm business firm could operate at a loss for a while and still grow if reinvestment funds were coming from an outside source. But this would imply a decided inefficiency of operation at an earlier starting state.

Minimum starting size.--For growth to take place, the farm business must be large enough to support the farm family and also to provide some surplus cash for expanding the resources, unless there is a supplemental nonfarm source of income. If the farm business is too small to support the family or occupy it full time, the operator or his wife may have a full-time or part-time job. Farm and nonfarm earning activities together must supply some cash beyond the minimum family living needs.

A young orchard farmer who has a full-time nonfarm job may use his free time to set out seedling trees. And he may keep the full-time job until the fruit trees have come into bearing. A young wheat farmer may use borrowed machinery to operate a few acres of share-rented land for a year or two. He may custom hire the combining or hauling.

If the firm is to grow, there must be some surplus cash with which to expand the control over resources. Total volume of resources controlled and employed by the farm firm must increase. This requirement stems partly from our definition which says that growth is an increase in output--volume and sales value--which in turn requires an increase in inputs and resources employed.

Some unused resources.--The next necessary condition for growth of the farm business firm is drawn from a book by Edith Penrose, although she does not specify it as a necessary condition.[3] She observes that firms having opportunity for growth are often those that in effect find themselves with some unused production services--a term she prefers over the term resources. A firm with some unused resources obviously is in a state of disequilibrium. The unused or surplus production services may have resulted from any of several legitimate causes, perhaps due to disequilibrium in the factor market.

For example, suppose a firm finds itself unable to buy a needed waterproof component used in fabricating a product. The firm employs research technicians and equips a laboratory to develop a new process of waterproofing which eventually becomes successful, allowing the firm to become its own supplier of the waterproof component. Now the firm discovers that it possesses an expert staff on waterproofing processes and materials, and that an eager market for the new product exists. So the firm decides to expand output of the waterproofing and sell to other users as well.

There may be no closely parallel examples in agriculture. But farmers do purchase cattle to consume farm-grown feeds, purchase calves to pasture crop aftermath, custom combine grain for other farms, and so on. These are like the unused managerial capacity in their relationship to growth. In each instance, growth

[3] Edith T. Penrose, "Theory of Growth of the Firm," John Wiley and Sons, New York, 1959.

of the farm business firm occurs from a starting position of disequilibrium. We need not concern ourselves here with what caused the disequilibrium in the first place.

In a firm already well organized and adjusted, and with no unused resources, growth might consist of duplicating or expanding the present setup. In this case there must be unused managerial capacity.

Added resources procurable.--Because growth in a firm requires control over additional resources, the additional resources must be available to or procurable by the firm. The farmer needing additional land must be able to find land for rent or sale. In almost any dryland wheat county, good land is available for renting to the more competent farm operators. The good farmers can usually share-lease additional land. Good tenants are sought after by landlords.[4] If additional power and machinery services are required, the firm operator can consider obtaining them by hire.

Example of Growth

My example shows the managerial strategies that a young Montana wheat farmer might use to achieve firm growth. With an initial capital of $4,000 the farmer progresses from the operation of an 830-acre dryland wheat farm to a 1,700-acre farm in 5 years. This growth is achieved by using the strategies of renting or custom hiring the production services to the greatest extent possible, and of owning capital resources to the smallest extent possible. The data are adapted from a Montana study.[5] The income and expenses for three stages of operation are shown in table 1.

[4] Additional land may be less available to farm operators in other areas. In the Plains, much land is available for crop renting in less than whole farm size tracts.

[5] "Land Use Alternatives for Dryland Cash Grain Operators, North Central Montana," AER Report No. 9, Dept. Agri. Econ. and Rural Sociol., Mont. Agr. Expt. Sta., Bozeman, Nov. 1959.

Table 1.--Example of cash income and expenses on typical wheat farms, Montana, 1959[1]

Item	830-acre farm			1,200-acre farm			1,700-acre farm		
	Total	Tenant	Landlord	Total	Tenant	Landlord	Total	Tenant	Landlord
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Cash income.....	10,045	7,534	2,511	14,551	10,913	3,638	20,626	15,470	5,156
Cash expenses:									
Fuel, oil, repairs..	517	517	--	651	651	--	1,486	1,486	--
Grain storage.....	298	224	74	431	323	108	611	459	152
Seed treatment.....	37	37	--	53	53	--	75	75	--
Weed spraying.....	500	375	125	723	542	181	1,025	769	256
Motor vehicles.....	276	276	--	295	295	--	644	644	--
Insurance.....	127	95	32	132	96	36	206	165	41
Taxes.....	374	104	270	537	147	390	784	236	548
Miscellaneous.....	75	75	--	100	100	--	125	125	--
Custom harvest and hauling.....	1,200	1,200	--	1,733	1,733	--	--	--	--
Total cash expense	3,404	2,903	501	4,655	3,940	715	4,956	3,959	997
Net cash income.....	6,641	4,631	2,010	9,896	6,973	2,923	15,670	11,511	4,159
Family living expense	2,400	2,400	--	2,400	2,400	--	2,400	2,400	--
For reinvestment.....	4,241	2,231	--	7,496	4,573	--	13,270	9,111	--
Depreciation.....	1,408	1,271	137	1,756	1,558	198	3,263	3,004	259

[1] Adapted from Montana AER Rpt. No. 9.

The young operator starts by crop share-renting an 830-acre farm having 400 acres in crops and 400 in fallow. Wheat is $1.60 a bushel, barley is $0.60; operating expenses are at the 1959 level.

The young operator uses $2,500 of his capital as a downpayment on a second-hand tractor and other wheat farming machinery, excluding a grain combine and a motortruck. Harvesting and hauling are custom hired. The remaining $1,500 of his capital, supplemented by dealer and merchant credit, is used to pay production and family living expenses until the first crop is harvested. Thereafter, expenses are paid from income of the preceding year.

With normal yields, net cash income is sufficient to meet all cash expenses of the farm, plus the amortization payment on the farm machinery; it provides $2,400 for family living, and a surplus of $1,080 for reinvestment (table 2). The books will show $1,271 in annual depreciation.

The surplus cash from 2 years of operation is sufficient for the downpayment on enough additional machinery to operate a 1,200-acre wheat farm during the third year. After 2 years of operation on the 1,200-acre farm the operator can finance the additional machinery and equipment to operate a share-rented 1,700-acre farm during the fifth year. This time the purchases can include a grain combine harvester and a motor truck. The harvesting and grain hauling will no longer be custom hired. Net cash income on the 1,700-acre farm would be about 2-1/2 times as large as on the 830-acre farm 5 years earlier.

The rate of firm growth is delayed if the cash expenses for family living are $3,000 annually

Table 2.--Five-year growth of tenant-operated wheat farm showing allocation of cash income, estimated net worth, and accumulated machinery depreciation

Item	1st year	2nd year	3rd year	4th year	5th year
Cropland farmed, acres.....	800	800	1,156	1,156	1,640
	Dollars[1]	*Dollars*[1]	*Dollars*[1]	*Dollars*[1]	*Dollars*[1]
Gross cash income.....	7,534	7,534	10,913	10,913	15,470
Cash expenses.....	2,903	2,903	3,950	3,950	3,959
Net cash income.....	4,631	4,631	6,963	6,963	11,511
Amortization payment[2].....	1,151	1,151	1,786	1,786	3,318
Family living expenses.....	2,400	2,400	2,400	2,400	2,400
Net cash for reinvestment.....	1,080	1,080	2,777	2,777	5,793
Down payment[3].....	--	1,300	--	3,140	--
Cumulative surplus.....	1,080	860	3,637	3,274	9,067
Machinery equity, year end[4]...	1,912	2,821	2,657	5,730	5,410
Net worth.....	2,992	3,681	6,294	9,004	14,477
Accumulated machinery depreciation.....	1,271	2,542	4,100	5,658	8,662

[1] Tenant operator's share only.
[2] Includes interest and payment on principal.
$4,721 borrowed before 1st year: 5-year loan at 7%.
$3,905 borrowed end of 2nd year: 5-year loan at 7%.
$9,420 borrowed end of 4th year: 5-year loan at 7%.
[3] One-third of purchase price.
[4] Sum of downpayments plus payments on principal less cumulated depreciation.

instead of $2,400 as assumed. Then the first step in growth--from 800 to 1,156 crop acres--would be delayed from the third to the fourth year. And all succeeding steps would be correspondingly delayed. If family cash expenses begin at $2,400 as assumed but increase to $3,000 the third year, then the projected growth (step two) to 1,640 crop acres cannot be accomplished as planned in the fifth year. The example illustrates the critical importance to the farm family of keeping living expenses to a minimum in the early years.

Instead of expanding his grain enterprises, the young operator could have used his cash surplus to develop a small livestock feeding enterprise on his initial 830-acre farm. Although we did not budget this alternative, the enterprise usually shows far lower rates of return than the grain enterprises. Livestock feeding would represent the direction firm growth would have to take if more land could not be acquired.

Implications for Research

The concept of the growth of the farm business firm provides a much more realistic setting for production economics analysis than the older view of a static firm in a static world. First, the concept modifies the traditional approach to problems of resource allocation by recognizing dynamic factors formerly neglected or overlooked. The concept introduces new and different objective functions which in turn make possible a new and more accurate approach to analyses of production response. The concept also adds another dimension to our views on farm finance. Without growth, financial management of the farm is a one-time budgeting of debt and of income flows; with growth, debt becomes a powerful management strategy. Thus the concept of growth of the firm puts meaning into the term "financial management."

In the long view, the financial management of U.S. farms has gone through three phases. In Phase I, land was so cheap (almost free) that the goal of immediate and full ownership by farmers was unquestioned. In Phase II, land had acquired some value, but a prudent and industrious farmer could eventually become a debt-free owner. Now, in Phase III, land is so expensive that full ownership of an adequate farm is no longer a feasible goal. This evolution is causing us to begin to explore alternative goals. Investment in other factors of production may often represent a more profitable use of the farmer's limited financial resources.

Formulation of a Transhipment Problem Involving Time

By Mack N. Leath and James E. Martin

MANY METHODS of formulating transhipment problems are available to the researcher. Methods of incorporating maximum and minimum capacity restraints on supplies, demands, and transportation modes in multistaged transportation models have been illustrated elsewhere.[1] This paper illustrates a method of incorporating many of these concepts into a time-staged model. Time-staging is introduced into a multifactor, multiproduct, multiregion, and multiplant problem, and the formulation and optimal or minimum cost solution of a hypothetical two-product, five-stage spatial equilibrium problem are presented. The five stages--production, acquisition, inventories, processing, and distribution--are considered for each product for two areas. As products flow through the system, each product competes for the limited storage space and processing facilities of each area, yet product identity is maintained throughout the five stages. The problem considered is of a type frequently encountered in research projects involving spatial equilibrium analysis.

Mathematical Definition of the Model

The objective of the model is to minimize a linear function subject to certain linear restraints. The conventional mathematical definition of the model may be stated as:

(1) Minimize $C = \sum_{ij} C_{ij} X_{ij}$

where $i = 1,2,\ldots m$

and $j = 1,2,\ldots n$

Subject to the constraints:

(2) $\sum_{j} X_{ij} = S_i$

(3) $\sum_{i} X_{ij} = D_j$

(4) $\sum_{i} S_i = \sum_{j} D_j$

(5) $X_{ij} \geqq 0$

where C_{ij} is the cost of transferring a unit of the product from shipping point i to receiving point j, s_i is the supply of a product at the ith shipping point, D_j is the demand for a product at the jth receiving point, and X_{ij} is the number of units of the product which should be shipped from S_i to D_j to minimize the total cost of transfer of products.

Equation (4) is the restraint that insures equality of total supply and total demand. For the readers who are not familiar with the transportation model, a more detailed verbal explanation of the model is presented by Earl O. Heady and Wilfred Candler in Linear Programming Methods (Iowa State University Press, Ames, Iowa, 1958, pp. 332-377).

General Matrix Format of the Model

The locations of various elements of costs, supplies, and demands in general matrix format are depicted in figure 1. The format consists of "m" supplies, "n" demands, and "m x n" cost elements (C_{ij}). The format of the corresponding shipment matrix is presented in figure 2.

[1] Mack N. Leath and James E. Martin, "The Transhipment Problem With Inequality Restrains," Jour. Farm Econ. 48(4): 894-908, Nov. 1966.

S_i \ D_j	D_1	D_2	D_n	i
S_1	C_{11}	C_{12}	C_{1n}	1
S_2	C_{21}	C_{22}	C_{2n}	2
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
S_m	C_{m1}	C_{m2}	C_{mn}	m
j	1	2	n	

Figure 1.--Matrix of supplies (S_i), demands (D_j), and costs (C_{ij}).

S_i \ D_j	D_1	D_2	D_n	i
S_1	X_{11}	X_{12}	X_{1n}	1
S_2	X_{21}	X_{22}	X_{2n}	2
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
S_m	X_{m1}	X_{m2}	X_{mn}	m
j	1	2	n	

Figure 2.--Matrix of supplies (S_i), demands (D_j), and shipments (X_{ij}).

As stated in equation (5) above, X_{ij} is the nonnegative quantity of a product shipped from the ith location to the jth destination.

If total real supplies exceed total real demands, a dummy demand must be included. Shipments to the dummy demand from any supply location incur no costs and merely represent inventory at points of shipment after real demands have been satisfied.

A Formulation Illustrating Time-Staging

The hypothetical problem considered is a spatial equilibrium problem related to the production, processing, and distribution of grain and grain products for two successive time periods. Two grains, hard wheat (HW) and soft wheat (SW), are considered, and an optimal shipment pattern for the hypothetical grain industry is obtained. The hypothetical industry consists of (1) two primary production regions, (2) two primary products, (3) two storage regions, (4) two processing regions, (5) two regions demanding primary products, and (6) two regions demanding particular proportions of the processed products.[2]

[2] The unit of measure for the processed products is stated in terms of the equivalent quantity of the primary product.

The model is formulated so that each type of wheat may be used for livestock feed in the area of production. Supplies in excess of local feeding demands are shipped to storage areas. After grain is transferred into storage, it may be shipped to flour mills for processing or used to satisfy whole grain feeding demands in other areas. Shipments may move directly through a storage facility at the "in-handling" and "out-handling" costs. Or, if total grain supply exceeds the various demands, grain may remain in storage for one or more time periods, in which case storage costs are incurred.

The whole-grain receiving capacity of each storage area is the available storage capacity multiplied by the number of grains received. Thus, the receiving capacity of each storage area in the problem under consideration is twice the actual storage capacity. However, the products compete for the limited storage space, and when the volume received is greater than storage capacity, a portion must be shipped out rather than stored. This is a realistic feature of the model because elevators frequently receive volumes of grain in excess of storage capacity during harvest season.

The processing capacities of processing regions are handled in a slightly different way in the model. The processing capacity of each area is allocated to the processing of each grain in the ratios that these products have to

Figure 3. An example illustrating the time-staging of a transportation problem

Matrix of costs, supplies, capacities and demands

		Primary Product Storage												Processing Facilities								Whole Grain Demands								Flour Demands								Slack		
	Time Period	I						II						I				II				I				II				I				II						
Time Period	Region / Product[1]	1 HW	2 HW	1 SW	2 SW	1 –	2 –	1 HW	2 HW	1 SW	2 SW	1 –	2 –	1 HW	2 HW	1 SW	2 SW	1 HW	2 HW	1 SW	2 SW	1 HW	2 HW	1 SW	2 SW	1 HW	2 HW	1 SW	2 SW	1 HW	2 HW	1 SW	2 SW	1 HW	2 HW	1 SW	2 SW	– –	S_i	i
	(Production)				A																				B															
I	1 HW	4	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	1
	2 HW	9	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	2
	1 SW	.	.	4	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	70	3
	2 SW	.	.	9	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	20	4
											C																		D										
II	1 HW	.	.	.	.	.	.	4	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	30	5
	2 HW	.	.	.	.	.	.	9	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	50	6
	1 SW	.	.	.	.	.	.	.	.	4	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	30	7
	2 SW	.	.	.	.	.	.	.	.	9	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	10	8
	(Storage)				E		F				G						H								I														
I	1 HW	0	.	.	.	12	.	6	.	.	.	.	.	18	21	.	.	.	.	.	.	3	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	9
	2 HW	.	0	.	.	.	10	.	5	.	.	.	.	22	19	.	.	.	.	.	.	7	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	10
	1 SW	.	.	0	.	12	.	.	.	6	.	.	.	.	.	18	21	.	.	.	.	.	.	3	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	11
	2 SW	.	.	.	0	.	10	.	.	.	5	.	.	.	.	22	19	.	.	.	.	.	.	7	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	12
							J						K																											
	1 —	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	13
	2 —	.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	14
											L		M				N				O																		
II	1 HW	.	.	.	.	.	.	0	.	.	.	6	.	.	.	.	.	18	21	.	.	.	.	3	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	15
	2 HW	.	.	.	.	.	.	.	0	.	.	.	5	.	.	.	.	22	19	.	.	.	.	7	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	16
	1 SW	.	.	.	.	.	.	.	.	0	.	6	.	.	.	.	.	.	.	18	21	.	.	.	.	.	.	3	8	.	.	.	.	.	.	.	.	.	.	40	17
	2 SW	.	.	.	.	.	.	.	.	.	0	.	5	.	.	.	.	.	.	22	19	.	.	.	.	.	.	7	5	.	.	.	.	.	.	.	.	.	.	60	18
													P																									Q		
	1 —	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	40	19
	2 —	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	60	20
	(Processing)																R																S							
I	1 HW	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12	16	.	.	.	.	.	.	.	.	40	21
	2 HW	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17	13	.	.	.	.	.	.	.	.	30	22
	1 SW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12	16	.	.	.	.	.	.	20	23
	2 SW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17	13	.	.	.	.	.	.	15	24
																					T												U						
II	1 HW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12	16	.	.	.	40	25
	2 HW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17	13	.	.	.	30	26
	1 SW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12	16	.	20	27
	2 SW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17	13	.	15	28
	D_j	40	60	40	60	40	60	40	60	40	60	40	60	40	30	20	15	40	30	20	15	15	10	5	25	15	10	5	25	30	20	15	10	30	20	15	10	50		
	j	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37		

[1] HW refers to hard wheat, and SW refers to soft wheat.

. Denotes that costs are sufficiently high to prevent entry in the optimal solution.

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each other in total final demand for flour. If total processing capacity were made available to each grain, total capacity of a given area might be exceeded. The method employed to allocate the capacity between the two types of wheat insures that processing capacity in each milling region is not exceeded. It also permits flexibility in the actual quantity of each grain processed in each area, since the restriction only imposes a maximum on the volume processed.

The matrix of costs, supplies, capacities, and demands used in this simplified hypothetical problem is presented in figure 3. Note that costs, demands, and capacities are identical for both time periods. However, production is reduced in both areas during the second time period. Costs used in the problem may be interpreted as follows:

Submatrices A and C: Costs include transit to storage areas from area of production plus in-handling costs by type of grain.

Submatrices B and D: Costs include transit plus handling and on-farm storage costs to meet feeding demands in areas of production.

Submatrices E, J, K, L, P, R, and T: Zeros are entered on main diagonals. Shipments made over routes in E, L, R, and T represent unused capacities in storage and processing. It is assumed that no costs are incurred when capacity goes unused. Shipments made over routes in J, K, and P are dummy shipments and serve only as accounting entries in the model. Hence, no costs are incurred.

Submatrix F: Costs include all storage charges for two full time periods by area and type of grain.

Submatrices G and M: Costs include all storage charges for one full time period by area and type of grain.

Submatrices H and N: Costs include out-handling costs at storage facility, plus transit charges from storage to milling facility, plus in-handling costs at milling facility, plus processing costs by type of wheat and area.

Submatrices I and O: Costs include out-handling costs at storage facility plus transit to feeding demand areas by type of grain.

Submatrix Q: Zeros are entered in both cells.

Submatrices S and U: Costs include out-handling costs at milling facility plus transit to flour demand centers.

The C_{ij} cells containing dots (.) represent an infinite cost to prevent entry of these "routes" into the optimal shipment pattern.

The shipment matrix for a minimum cost solution is presented in figure 4. The minimum cost associated with the required shipments is 6,715 units. This cost cannot be read directly from figure 4. However, the cost of any solution is always the sum of the units flowing along each route multiplied by the cost of using the route. Hence, the total cost = $\sum_{ij} C_{ij} X_{ij}$ where C_{ij} is the cost of transferring a unit of the product from S_i to D_j (fig. 3) and X_{ij} is the number of units of the product shipped from S_i to D_j (fig. 4). In the following discussion, the letter designating the submatrix will be followed by subscripts denoting the particular cell within the submatrix, when reference is made to a particular cell of the shipment matrix. For example, C_{34} refers to the cell in the third row and in the fourth column of submatrix C.

As stated above, the initial movement of whole grain from the production regions may be to local feeding demands or to storage facilities. Entries in submatrices A and C represent shipments of whole grain by type of grain to the storage regions from areas of production.[3] For example, 45 units of hard wheat moved from production region 2 to storage region 2 in time period I; this movement is depicted by the entry in cell A_{22} of figure 4. Note that the total storage capacity of 40 and 60 units in storage regions 1 and 2, respectively, are made available to each grain. Consequently, the maximum quantity that a storage region may receive in one time period is twice the capacity. Excess receiving capacity by type of grain for each storage area is represented by entries in submatrices E and L. These entries are dummy shipments and no costs are incurred.

Entries in submatrices B and D represent quantities of each grain used in the production regions to satisfy whole-grain demands for feeding. These quantities do not move through storage facilities. However, should production

[3] When reference is made to two submatrices together, the two submatrices refer to time periods I and II, respectively.

Figure 4. An example illustrating the time-staging of a transportation problem

Matrix of shipments

		Primary Product Storage												Processing facilities								Whole Grain Demands								Flour Demands								Slack			
	Time Period	I						II						I				II				I				II				I				II							
Time Period	Region / Product[1]	1 HW	2 HW	1 SW	2 SW	1 –	2 –	1 HW	2 HW	1 SW	2 SW	1 –	2 –	1 HW	2 HW	1 SW	2 SW	1 HW	2 HW	1 SW	2 SW	1 HW	2 HW	1 SW	2 SW	1 HW	2 HW	1 SW	2 SW	1 HW	2 HW	1 SW	2 SW	1 HW	2 HW	1 SW	2 SW	– –		S_i	i
	(Production)				A																				B															
I	1 HW	25	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	1
	2 HW	5	45	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	2
	1 SW	.	.	40	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	70	3
	2 SW	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	20	4
											C																	D												
II	1 HW	.	.	.	.	.	.	15	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	.	.	.	.	.	.	.	.	.	.	.	.	.	30	5
	2 HW	.	.	.	.	.	.	15	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	50	6
	1 SW	.	.	.	.	.	.	.	.	25	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	30	7
	2 SW	.	.	.	.	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	10	8
	(Storage)				E		F				G						H								I															
I	1 HW	10	.	.	.	0	.	0	.	.	.	.	.	30	0	.	.	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	9
	2 HW	.	15	.	.	.	25	.	0	.	.	.	.	0	20	.	.	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	10
	1 SW	.	.	0	.	0	.	.	.	15	.	.	.	.	.	20	5	.	.	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	11
	2 SW	.	.	.	35	.	0	.	.	.	20	.	.	.	.	0	0	.	.	.	.	.	.	0	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	12
							J						K																											
	1 —	.	.	.	.	40	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	13
	2 —	.	.	.	.	.	35	.	.	.	.	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	14
											L		M							N								O											
II	1 HW	.	.	.	.	.	.	10	.	.	.	0	.	.	.	.	.	30	0	.	.	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	40	15
	2 HW	.	.	.	.	.	.	.	35	.	.	.	5	.	.	.	.	0	20	.	.	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	60	16
	1 SW	.	.	.	.	.	.	.	.	0	.	20	.	.	.	.	.	.	.	15	5	.	.	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	40	17
	2 SW	.	.	.	.	.	.	.	.	.	40	.	0	.	.	.	.	.	.	0	5	.	.	.	.	.	.	0	15	.	.	.	.	.	.	.	.	.	.	60	18
													F																									Q		
	1 —	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20		40	19
	2 —	.	.	.	.	.	.	.	.	.	.	.	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30		60	20
	(Processing)																R												S											
I	1 HW	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30	0	.	.	.	.	.	.	.	.	40	21
	2 HW	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	20	.	.	.	.	.	.	.	.	30	22
	1 SW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	5	.	.	.	.	.	.	20	23
	2 SW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	5	.	.	.	.	.	.	15	24
																				T															U					
II	1 HW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30	0	.	.	.	40	25
	2 HW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	20	.	.	.	30	26
	1 SW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	0	.	20	27
	2 SW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	10	.	15	28
	D_j	40	60	40	60	40	60	40	60	40	60	40	60	40	30	20	15	40	30	20	15	15	10	5	25	15	10	5	25	30	20	15	10	30	20	15	10	50			
	j	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37			

[1] HW refers to hard wheat, and SW refers to soft wheat.

. Denotes that cells were not in the optimal solution because costs were sufficiently high to prevent entry.

of a given grain in either area be insufficient to satisfy local feeding demands, as is the case for soft wheat production in area 2, additional quantities of grain can be shipped in from the storage facilities to meet these deficits. Entries in submatrices I and O represent shipments of this nature by area and by type of grain.

Once the demands for whole grain have been satisfied, the remaining quantities of grain may remain in storage or may be shipped out to flour mills for processing. Grain moving through storage facilities to milling facilities in period I does not incur storage costs. These shipments by area and type of grain are represented by entries in submatrix H. Grain moving from storage facilities to milling facilities in period II is represented by entries in submatrix N. If these quantities are produced in period II, no storage costs are incurred as the grain only moves through the storage facilities. However, should this be grain produced in period I, storage costs will be incurred for period I. The method in which the storage costs are incurred is discussed later. Excess processing capacity is represented by entries in submatrices R and T by area and type of grain. These are dummy shipments and no costs are incurred. For example, excess capacity in period I is determined for each area by summing alternate entries on the main diagonal in R. Thus, the excess capacities are 10 and 20 units for milling areas 1 and 2, respectively. Entries in submatrices S and U represent shipments of the processed products from flour mills to flour demand areas. In this formulation, no provisions are made for flour storage. Consequently, the quantities of grain received in each processing region through submatrices H and N are identical to the quantities of flour shipped from each processing region through submatrices S and U.

Quantities of grain produced in excess of whole-grain and flour demands remain in storage, and storage costs are incurred. The quantities of grain moving into storage are represented by entries in submatrices F, G, and M. Entries in submatrix F incur storage costs for two time periods. Thus, the 25 units of hard wheat (the shipment through route F_{22}) enter storage for two complete time periods, and these units are not available for shipment in the second time period. Alternatively, quantities produced in period I may move into storage through routes located on the main diagonal of submatrix G; in this case, storage costs are incurred for the first time period only. Consequently, these quantities as well as quantities shipped in from areas of production in the second time period (submatrix C) are available to meet various demands in period II. Thus, the quantities available at the storage facilities for shipment in period II are as follows: hard wheat in storage area 1 is 30 units ($C_{11} + C_{21} + G_{11} = 15 + 15 + 0 = 30$ units); hard wheat in storage area 2 is 25 units ($C_{12} + C_{22} + G_{22} = 0 + 25 + 0 = 25$ units); soft wheat in storage area 1 is 40 units ($C_{33} + C_{43} + G_{33} = 25 + 0 + 15 = 40$ units); and soft wheat in storage area 2 is 20 units ($C_{34} + C_{44} + G_{44} = 0 + 0 + 20 = 20$ units).

After the feeding and processing demands for grain have been satisfied in period II, the remaining quantities of grain located at the storage facility move into storage and incur storage costs during the second time period. These quantities are represented by entries in submatrix M. Thus, 5 units of hard wheat (M_{22}) move into storage in area 2, and 20 units of soft wheat (M_{31}) move into storage in area 1. These entries do not represent total storage in period II since entries in submatrix F remain in storage for two complete time periods.

The quantities of grain stored by area and type of grain for each time period are determined from the shipment matrix presented in figure 4. During period I, the volume stored in area 1 is 0 units of hard wheat ($F_{11} + G_{11}$) plus 15 units of soft wheat ($F_{31} + G_{33}$) or 15 units. The volume stored in area 2 is 25 units of hard wheat ($F_{22} + G_{22}$) plus 20 units of soft wheat ($F_{42} + G_{44}$) or 45 units. Thus, total volume moving into storage and incurring storage costs in the first time period is 60 units. This quantity may be verified by subtracting total final demands in period I from total production during this period. Likewise, for period II, volume stored in area 1 is 0 units of hard wheat ($F_{11} + M_{11}$) plus 20 units of soft wheat ($F_{31} + M_{31}$) or 20 units, and volume stored in area 2 is 30 units of hard wheat ($F_{22} + M_{22}$) plus 0 units of soft wheat ($F_{42} + M_{42}$) or 30 units. Thus, total volume stored in period II is

50 units. These ending inventories also appear in submatrix Q by area but not by type of grain (area 1 = Q_{11} = 20 units and area 2 = Q_{21} = 30 units).

Entries in submatrices J, K, and P are dummy shipments, and no costs are incurred. Even though these entries are only accounting entries in the model, interpretation reveals useful information related to the storage facilities. Since entries in submatrix F represent quantities of grain produced in period I and stored for two full time periods, entries in submatrix J represent the storage space available in period I by area, after the space used by entries in F has been accounted for. Entries in submatrix K represent the quantities of grain moving into storage for two full periods through routes in F at the beginning of the first period. These quantities in K appear by area but not by type of grain; hence, $K_{11} = F_{11} + F_{21}$ and $K_{22} = F_{22} + F_{42}$. Since shipments over routes in submatrix Q to the slack or dummy demand represent the ending inventories in storage during the last period, the entries in submatrix P represent the unused storage capacity in each storage area during this period.

In this formulation, it is possible for the volume stored to exceed storage capacity in any area during the first time period. This will happen if a storage area is filled by entries in submatrix F (these quantities incur storage costs for two full periods) and if additional quantities (which incur storage costs for the first period) are shipped to the area through submatrix G. Should this happen, it will be corrected in period II because storage will not exceed capacity unless D_{37} (dummy demand) is greater than total storage capacity, and the quantities stored in excess of capacity will be forced out of storage. In this situation, where the maximum restraint on storage is violated, the accounting of the model is still correct because all units in excess of capacity incur storage costs.

Violation of storage capacity restraints may at first appear to be a major weakness of the model, but it can be a very realistic feature. Many elevator operators may actually store excess grain on the ground or in temporary facilities during the peak harvest season, until storage space becomes available in the regular facilities or until the grain can be sold. Thus, this feature of the model makes it possible to determine what areas need additional storage facilities. Likewise, if the storage capacity of any area is consistently underutilized, it might suggest a need to reduce the available storage capacity in the area.

The problem of degeneracy is much more likely to occur in multistage transportation models involving multiple periods of time than in the conventional single-stage model. Multistage problems must be formulated with care to insure that the supplies available for shipment over permitted routes are adequate to satisfy the given demands, since shipments over nonpermissible routes (routes containing an infinite cost coefficient) will yield an infeasible solution.

Modifications of the Model

The researcher can make several modifications in the model presented in figure 3. A few of these modifications are mentioned in the hope of stimulating further thought in this area.

A very useful modification is that of a minimum capacity restraint to insure that a minimum percentage of storage capacity will be utilized in each storage region. This type of restraint might be desirable when Government policy is aimed at maintaining grain storage at a specified minimum percentage of capacity in the respective regions. A technique of introducing such a restraint is illustrated in another paper by the present authors (see footnote 1).

Other restraints discussed in this article which may be included in the time-staged transportation model are (1) restrictions on the total quantity that may be shipped from a specified group of supply points, (2) minimum and maximum restraints on a particular supply or demand area, and (3) restrictions on the quantity of a commodity that can be shipped at a given transportation rate where alternative modes of transportation are available. The third restriction is useful where only a limited quantity may be shipped at a particular rate.

If transit rates are a characteristic of the problem, restrictions on quantities received at demand areas by various modes of transportation may be imposed in the formulation of a

problem. The introduction of transit rates into the transportation model is illustrated in a study by Uhrig.[4]

Additional time periods can be included in the model presented in figure 3. Expansion to four time periods, for example, would involve duplicating the supplies and demands with the appropriate S_i and D_j quantities, and a change in the cost coefficients in the submatrix corresponding to submatrix F (fig. 3) to include all storage charges for four time periods. Likewise, the submatrix corresponding to submatrix M would represent storage charges for three periods, and cost coefficients in the corresponding submatrices for periods III and IV would be for two periods and one period of storage, respectively.

The formulation of the spatial equilibrium model presented may also be extended to include multiple levels of storage and processing. Only one level of each was considered above because of space limitation. If one were considering the grain industry, for example, it would probably be desirable to include terminal storage facilities in addition to the country storage facilities located near the areas of production.

Application of the Transportation Model in Spatial Equilibrium Research

Many problems of the spatial equilibrium type lend themselves to the time-staged transportation model. Use of the model can reduce the time required to prepare the problem as well as data processing time. Any spatial equilibrium problem that can be formulated within the framework of the transportation model can be set up as a general linear programming problem. However, if the problem under consideration is a large one, a linear programming formulation might be unmanageable, or the number of equations might exceed the capacity of the linear programming system. On the other hand, large problems might be solved more efficiently if formulated within the framework of the transportation model.

Formulations similar to the one presented should be feasible for many agricultural commodities or commodity groups. Given the available supplies at various origins, requirements at various demand centers, and transfer changes between regions for the commodity under consideration, efficient shipping patterns can be determined which will minimize total transfer costs. A formulation of the model describing the activities of a single firm could be very useful in directing its trucking and other operations. An optimal solution for a problem describing the activities of an industry could be useful, especially to new firms entering the industry, in suggesting which markets should be investigated first or where facilities should be located.

An industrywide solution for a commodity could prove useful to the Government in determining where CCC-owned stocks should be stored to minimize assembly and distribution costs. Alternatively, given the location of stocks, one could easily determine which stocks should be utilized to meet the requirements of various export sales in order to minimize transfer costs to dock facilities.

We believe that the method in which storage facilities are incorporated into the model represents a refinement of the transportation model. Generally, regional storage demands are built into economic models under the implicit assumption that all storage takes place at the point of production.[5] In the model presented in figure 3, there is no restriction that storage be located at the point of production. The storage facilities are connected to the production areas by transportation rates and are spatially separated from the regions of production.

[4] John William Uhrig, "Economic Effects of Changes in Transportation Rates and Processing Capacity on Soybean Procurement by Iowa Processors," unpublished Ph.D. dissertation, Iowa State University, Ames, Iowa, 1965.

[5] D. Lee Bawden, "An Evaluation of Alternative Spatial Models," Jour. Farm Econ. 46(5): 1372-1379, Dec. 1964.

World Grain Prices and Outlets for French Grain

By L. P. Schertz [1]

ON DECEMBER 14, 1964, the European Economic Community (EEC) decided upon harmonized grain prices to become effective on July 1, 1967.[2] Historically, prices have varied among the EEC member countries. Germany has had relatively high prices and France has had relatively low prices. Italy has had high wheat prices but low feed grain prices. With harmonization, these price differences will largely disappear as governmental barriers to trade among the EEC member countries are to be eliminated. Market prices will still vary somewhat among the member countries, but these differences are expected to be largely associated with marketing costs such as transportation.

There is much interest in the effects of the recent price decision on the potential distribution of French grain. One of the more important areas of interest is whether France will reduce its grain exports to non-EEC countries and increase its shipments of grain for use as feed to the deficit grain importing members of the EEC such as Germany. Sales to EEC members will have important effects on U.S. grain exports to the EEC, which in recent years averaged 6 million tons of feed grains and 1 million tons of wheat.

Disposition of French grain may be influenced by world prices of wheat and feed grains. This conclusion follows from an examination of prospective EEC budget costs of alternative means of disposing of French grain in excess of domestic needs. Either alternative, (1) exporting French grain to non-EEC countries or (2) selling denatured French wheat to other EEC countries, will involve EEC expenditures. (Denatured wheat is wheat made unfit for human consumption by the use of a dye or other material.) Costs of the two alternatives will be affected by the prices of grain in world markets. Thus, the disposition of French grain may be influenced by prices of U.S. grain exports.

Prospective EEC Grain Needs and French Supplies

By 1970, France is expected to produce annually over 8 million tons of grain above domestic needs. A large part of this excess is expected to be wheat (table 1). While some production may shift from wheat to barley, all projections anticipate a substantial quantity of wheat in excess of French needs.

In contrast to the expected excess for France, the net import needs of the five EEC members other than France may be over 15 million tons. The largest portion of this 15-million-ton deficit will be in feed grains. The other five members are expected to have a wheat deficit of 2.5 million tons. This deficit will be largely in kinds of wheat having a higher protein content than French wheat. Also, this estimate takes into consideration the practice of feeding wheat. These five members in the 3 crop years 1962-64,[3] for example, fed 2 million of the 5 million tons of wheat annually fed in the Community. France can be expected to supply small quantities of wheat for food, but the greatest need of

[1] The author is grateful to Richard J. Cannon for his assistance in the early development of the study upon which this article is based.

[2] See Newsletter on the Common Agricultural Policy, European Economic Community, No. 27, January 1965, for specific prices. Members of the EEC are Belgium, France, Germany, Italy, Luxembourg, and the Netherlands.

[3] Crop years beginning July 1. All years in this paper are crop years unless otherwise indicated.

Table 1.--EEC, selected grain statistics, average for 1961-63 crop years and projected 1970[1]

[Million metric tons]

Item	1961-63 average			Projected 1970		
	Wheat	Feed grain	Total	Wheat	Feed grain	Total
France:						
Production	12.7	12.7	25.4	16.2	14.7	30.9
Imports	.7	.6	1.4	--	--	--
Exports total	3.5	2.7	6.2	--	--	--
To non-EEC countries	3.1	1.6	4.7	--	--	--
Net exports	2.8	2.1	4.8	5.6	2.9	8.5
Domestic consumption:						
Total	9.8	11.0	20.7	10.6	11.8	22.4
Animal feed:						
On farms produced	2.5	6.8	9.4	--	--	--
From marketings	.7	2.6	3.3	--	--	--
Other five EEC countries:						
Production	15.0	17.5	32.5	16.2	19.6	35.8
Imports	3.6	13.4	16.9	--	--	--
Exports total	1.5	1.8	3.3	--	--	--
To non-EEC countries	1.4	1.3	2.6	--	--	--
Net imports	2.1	11.6	13.6	2.5	12.8	15.3
Domestic consumption:						
Total	17.4	28.9	46.4	18.7	32.4	51.1
Animal feed:						
On farms produced	1.4	10.2	11.6	--	--	--
Farm marketings	.5	12.7	13.3	--	--	--

[1]Crop years beginning July 1.

Source: 1961-63 average, Statistique Agricole: Office Statistique des Communautes Europeennes, miscellaneous issues. 1970 projections, average of three estimates presented in Perspectives "1970" de Production et de Consommation dans les Six Pays de la C.EE, Bureau Agricole Commun, Paris, May 1965.

these five members will be for grains for feeding. Thus, to fill the import requirements of these five, France will need to supply feed grains or denatured wheat. Feed grains include corn, barley, rye, oats, and minor cereals such as millet and speltz.

The technical process of denaturing wheat involves relatively low costs. At present EEC regulations allow $1.90 per metric ton to cover these costs (see EEC Regulations 96 and 178/64 for details on determination of denaturing subsidy).

Grain prices in the EEC will probably be administered so that French feed grains are consumed predominantly within the Community, but this result may not be initially achieved. In the event it is not, adjustment of support prices (derived intervention prices) of France should insure the utilization of the French feed grains in EEC countries. For example, lowering of derived intervention prices in France would permit market prices of French grain to drop sufficiently to become more attractive than those for imported feed grains to feed

mixers in such countries as Germany. Such reductions would not cause any reductions in the c.i.f. prices of imported grains, nor directly affect the variable levy assessed by the French government on imported grain. [4]

Prospective Budget Costs

The disposition of French wheat in excess of French needs will require expenditures from funds of the EEC. To export the wheat to non-EEC countries will require subsidies to lower the prices to world market levels. To utilize the wheat as feed will necessitate denaturing payments to make the price competitive with feed grain prices, as the market prices for milling wheat are substantially above feed grain prices.

The 1963 situation.--A comparison of exporting costs and denaturing costs for France in crop year 1963 is helpful in identifying the appropriate costs to consider under harmonized EEC price conditions. This comparison also helps to show the influence of world market prices on these costs. In 1963, the following subsidies were involved for activities in disposing of French grain (in U.S. dollars per metric ton):

Wheat export subsidy	[1] $44.57
Denaturing payment	21.26
Feed grain export subsidy.....	[1] 31.19

[1] Estimate based on average levy plus $6, an approximation of additional freight allowance.

The export subsidy in 1964 was somewhat higher than in 1963. The Commission now permits the payment of a freight allowance up to $12; in 1963 it permitted a maximum of $8. Price relations for 1963 instead of 1964 were used because of the sharp decrease in world market price for wheat in the early part of calendar 1965. This price change was not generally anticipated in the earlier part of crop year 1964 when initial plans for disposition of the French 1964 grain crop were considered. However, following the decrease in world market prices for wheat the denaturing subsidy was increased and the export subsidy was decreased. Both actions, although dependent undoubtedly on many considerations, were consistent with the relations presented in this paper. This paper assumes, for ease of presentation, that wheat for livestock feeding is equivalent to feed grains on an equal weight basis. This is probably not completely accurate, but does not invalidate the theme of the paper.

Because France is self-sufficient in feed grains, the use of wheat as feed in France has resulted in a related displacement of feed grains. In turn, feed grain export subsidies have been necessary to move the grain to non-EEC markets. Thus, the total budget cost for denaturing wheat (feed grain export subsidy plus denaturing payment) was approximately $52 per metric ton, $8 more than the cost of exporting wheat. Higher world market prices for wheat would have lowered the budget costs for exporting wheat without affecting the costs of the denaturing alternative. In contrast, higher world market prices for feed grains would have lowered the export subsidies for barley and thus lowered the budget costs for the denaturing alternative.

Presumably, France is exporting grain to member countries to the extent possible within the constraints of market conditions and EEC regulations. One of these constraints is the lack of minimum import prices for feed wheat. Thus, feed wheat, if it moved between countries, would presumably be subject to the food wheat levy. Also, if feed wheat was regularly made available for export to member countries, its free-on-frontier price would presumably be considered in determining the intra-EEC levy imposed on all French wheat.

Prospective situation.--Because the EEC is expected to be deficit in feed grains, the denaturing of wheat will not require feed grain export subsidies. The EEC, however, will have to forego receipt of feed grain levies on those imports displaced by denatured wheat. Alternatively, the exportation of wheat will enable the importation of a corresponding amount of feed grains and therefore the receipt of a levy.

[4] See L. P. Schertz, "Basic Provisions of European Economic Community Grain Regulations," FAS-M-106, U.S. Department of Agriculture, June 1963, for explanation of EEC variable levy system and internal price arrangements for grains.

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Feed grain levies can be taken into account by considering either (1) that the denaturing involves not only the payment of a denaturing subsidy but also foregoing the collection of a levy on a corresponding amount of feed grains, or (2) that the exportation of French wheat to non-EEC countries makes possible the collection of a levy on a corresponding amount of feed grains. The first approach was used in this paper although both lead to the same conclusions.

Based on historic levies and minimum import prices specified by the EEC on December 15, 1964, prospective 1967 costs of these various activities were estimated (table 2), assuming c.i.f. prices in 1967 equal to 1963 levels.[5] The resulting estimates indicate that, after harmonization of grain prices in the EEC, denaturing of wheat will become more attractive compared with exporting wheat than it has been in France. The prospective budget cost for wheat denaturing is $20 a ton plus the feed grain levy foregone of $34, giving a total cost of $54 a ton (table 2). In comparison, wheat exporting cost is expected to be $52, indicating a slight saving for exporting.

These assumptions involve many prices administratively controlled by the EEC or influenced by grain exporting countries. The EEC controls its internal prices and the grain exporting countries influence the c.i.f. prices.

The costs can be structured as follows:

Denaturing wheat (F):

Denaturing payment (D) = $C_w - C_g + a_1$

Feed grain levy (L) = $C_g - W_g + a_2$

Exporting wheat (E):

Export subsidy (S) = $C_w - W_w + a_3$

C_w and C_g are, respectively, the EEC prices of wheat and feed grains; W_w and W_g are the world market prices of the respective commodities; and a_1, a_2, and a_3 are other cost factors. Since $F = D + L$, the cost of denaturing reduces to $(F) = C_w - W_g + a_1 + a_2$.

The adjustments by the EEC in the price of wheat (C_w) will change the budget cost of each alternative by a corresponding amount. Adjustments in the EEC price of feed grain (C_g) would not affect the budget costs of either. For example, an increase in EEC prices for feed grains would reduce denaturing payments, but would cause an offsetting increase in the feed grain levy foregone. The EEC, in this case, is not in a position to affect costs of the alternatives.

In contrast, grain exporters can influence the comparable costs through prices of grains in world markets which, in turn, affect the magnitude of EEC export subsidies and levies. For example, an increase in world wheat prices (W_w) lowers the budget costs of the exporting alternative, but it does not affect the costs of the denaturing alternative. While an increase in c.i.f. feed grain prices (W_g) does not affect the costs of exporting, it does decrease the cost of the denaturing alternative.

Consequently, these relationships suggest that an increase in world wheat prices may encourage French wheat exports to non-EEC countries, while an increase in world feed

Table 2.--EEC: Selected grain export costs, and total cost comparisons of exporting and denaturing wheat, prospective situation, 1967[1]

[U.S. dollars per metric ton]

Item	Grain export cost	Total cost of--	
		Exporting wheat	Denaturing wheat
Denaturing payment.....	20	--	20.00
Export subsidies:			
Wheat.....	52	52.00	--
Barley.....	41	--	--
Levy receipts foregone:			
Wheat.....	46	--	--
Feed grains..	34	--	34.00
Total cost.....	--	52.00	54.00

[1] Crop year beginning July 1. Estimates based on 1963 c.i.f. prices and prospective EEC-administered and market prices.

[5] See Hans G. Hirsch, "The Fluctuation of EEC Variable Review," Foreign Agr. Trade of U.S., Aug.-Sept. 1965, for a discussion of the EEC variable levies and a historical series of grain levies. Also see Newsletter on the Common Agricultural Policy of December 15, 1964, for decision on harmonized grain prices.

grain prices may encourage the EEC to denature wheat and thereby substitute wheat for feed grain imports. Thus, disposition of the French excess wheat by feeding in the EEC or exporting to non-EEC countries may be influenced by relations between world prices of wheat and feed grains.

The readers is cautioned not to infer that these relationships justify adjustment of export prices by exporting countries to make one or the other alternative more attractive to the EEC. Determination of the impact of many other factors would be imperative before any such action is taken. Examples of those factors are domestic programs and legal requirements, effect on supply, stocking, and food aid programs of other countries, and the effect on the overall world wheat balance.[6] Further, many factors other than budget costs, such as balance of payments and trade relations, will be considered by the EEC and France in determining which alternative to pursue.

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[6] See Lyle P. Schertz and Richard J. Cannon, "U.S. Wheat Paramount in World Supply Situation," Foreign Agr., March 7, 1966, for a discussion of the responsibility the United States has assumed in past years in restraining wheat production, carrying stocks, and giving food assistance.

Book Reviews

In mid-1966, the National Commission on Food Marketing issued 10 technical studies and 12 supplements prepared by its staff or under contract. These releases followed the earlier publication of the Commission report entitled Food from Farmer to Consumer (discussed in the October 1966 issue of this journal). Because the technical studies provide the largest single body of available information on the U.S. food marketing system, they are reviewed in their entirety here. Copies of individual technical studies are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, at the prices indicated below. There are no sale copies of the supplements; requests for these should be sent to the Office of Information, U.S. Department of Agriculture, Washington, D.C. 20250.

Organization and Competition in the Livestock and Meat Industry. Technical Study No. 1.
189 pages. 1966. $0.55.

THIS STUDY, with its four supplements and statistical appendix, provides a concise description of industry structure. The analysis is conducted under the Bainsian framework. Students of the livestock-meat economy will find this report useful as a descriptive background, as a source of new data, and as a stimulus for new inquiry.

Much of the analysis is based on responses to rather lengthy mail questionnaires sent to 370 meatpackers and processors and many more cattle feeders. Usable questionnaires returned by meat packers and processors cover 65 percent of beef and veal production, 75 percent of commercial pork production, and 79 percent of commercial lamb production. While no population list on cattle feeders was available, the 851 usable returns cover 88 percent of cattle that were fed in feedlots with capacities of 1,000 head or more in the 15 States studied. Also, many data were acquired from the service, regulatory, statistical, and market research agencies of the Department of Agriculture. The supplements provide an excellent review of economies-of-scale studies and efficiency analyses. A minimum of data is presented in the main body of the report. However, almost all data collected from the questionnaires are summarized in the statistical appendix by both type of operation and size of firm.

Supplement No. 1, "Structure and Conduct of the Commercial Cattle Feeding Industry," provides a fairly complete description of structural change in this segment of the industry. Survey data are compared with reports made to the Packers and Stockyards Division, Consumer and Marketing Service. A detailed analysis of vertical market structure is made for Colorado and California. Current issues are well documented; future issues are defined.

Time prevented exhaustive analyses of the data collected. The three main areas of inquiry are earnings and concentration ratios, selling arrangements, and price spreads. Among other things, these analyses confirm the industry's reports of a rather low profit position in postwar years; however, firms with new plants of moderate size appear to be faring well.

Comparison of sales by product line to "most important" and "top 5" customers with total sales provides a simple but useful analysis of the forces behind the bargaining power controversy. The tabulation of formula pricing versus other methods of price determination points out the need for new research in pricing efficiency.

Concentration ratios are calculated in terms of both value added and pounds of meat produced. In terms of value added, this statistic shows a decline of 10 to 14 percentage points

for the top 4, top 8, and top 20 meatpackers. Leading meat processing firms have maintained about the same share of the market since 1954. In terms of volume, the top 4 firms have lost some of their market share, while firms ranking 5-8 have increased their share of the market slightly.

Retail prices collected by the Bureau of Labor Statistics (BLS) have long been suspect because of their inadequate coverage of weekend specials. An excellent case study of seven large food chains in the Washington, D.C., area measures the effect of the omission of weekend specials from BLS price statistics in the light of the volume retailed at special prices.

The effect of including weekend specials in the Washington area on the wholesale-retail price spread is calculated in both absolute and percentage terms. Margins based on accounting data covering the total operations of three large chains support the findings of the sample data--current BLS practices of collecting retail meat prices at midweek result in an overstatement of the wholesale-retail price spread. During the 6-month period under study in 1965, the wholesale-retail price spread for beef was overstated about 8 cents per pound in the Washington area when conventional BLS procedures were employed.

The Commission also investigated the time lag between price changes at the farm-wholesale and retail levels. Regression analyses were employed, using first differences of data for the 1962-65 period. Serial correlation still presented a problem in some instances. The equations indicate rather immediate price response between farm and wholesale levels, but retail prices are affected by wholesale prices of the 4 previous weeks.

Several time series are updated. Market channels are identified through 1964, and foreign trade in meat is traced through 1965. Other pertinent data in the report show numbers of cattle and lambs fed by packers in the sample and acquisitions and disposals of plants by large meatpacking firms.

Some of the conclusions and predictions of the final chapter are neither supported nor refuted by the data or analyses. The link between structure, conduct, and performance is not forged--a weakness of many structural analyses using Bain's model. If these conclusions are treated as hypotheses, they establish a basis for research over the next decade.

Richard J. Crom

Organization and Competition in the Poultry and Egg Industries. Technical Study No. 2.
118 pages. 1966. $0.40.

"AMONG AGRICULTURAL industries none changed so profoundly in the two decades following World War II as those of poultry and eggs." This opening sentence in the report sets the stage for the dramatic story of the poultry and egg industries as they changed in technology, organization, and location.

The report is primarily concerned with describing and documenting changes and, in some instances, with analyzing the consequences of these changes. The report is well written and brings together previously known information and new material that was secured by the Commission.

Much of the material on margins came from publications and specially prepared materials of the U.S. Department of Agriculture. Background material included studies of costs and economies of scale by universities and colleges and by the Department. Data on concentration came from the Bureau of the Census and other Government agencies.

New information on earning rates, sources of supply for processors, acquisitions and mergers, money spent on advertising, and new product development was secured by the Commission's special survey. Usable returns were obtained from 50 specialized chicken processors and 38 other firms that, in addition to other activities, processed or distributed poultry. Together, sales of these respondents covered 70 percent of Federally inspected slaughter. Fifty-nine firms, accounting for 62 percent of Federally inspected turkeys, returned questionnaires. Usable responses from 80 egg handlers accounted for 18 percent of commercial egg production. No attempt was made to expand these to the population. The high proportion of chickens and turkeys handled by reporting firms suggests that the data reflect general characteristics of the population. Returns from egg

handlers reflect mainly the characteristics of the larger farms.

The report is primarily descriptive. Analysis of industry structure is in terms of size of firms and share of market. Concentration ratios are used as the primary measure of competition in the industries. A Markov chain process based on transition probabilities is used as a technique for projecting changes that would take place in number and size of Federally inspected chicken and turkey processing plants. These projections imply that by 1972, 31 firms would be slaughtering 70 percent of the young chickens and 27 firms 70 percent of the turkeys, down considerably from the 55 firms for chickens and 35 firms for turkeys in 1964.

The report does not come to grips with the problem of performance in the poultry and egg industries. While time limited the scope and depth of the study, the magnitude of the changes in the broiler industry would have permitted some tentative conclusions about its performance. For example, how well have contract broiler growers fared? What sources of uncertainty have been reduced and how has this affected grower returns? Contracting is emerging in turkeys and eggs as well as in other agricultural industries.

In discussing the bargaining relationships between chicken and turkey processors and retailers, the report focuses on factors such as location of buyers and sellers and perishability of the product, rather than on size. This approach would have been helpful in other sections of the report.

The detailed information on earning rates, as well as other materials in the Supplemental Appendix to Technical Study No. 1 and Technical Study No. 2, are good starting points for further research.

The section of the report devoted to trends and prospects shows that with continued technical change the poultry industries will take on more characteristics of nonagricultural industry. The motivation for firms to grow by acquisition will probably be accelerated and concentration will increase through further mergers.

Although the report accomplishes the very difficult task of presenting a concise and informative study of the many facets of the poultry and egg industries, it is regrettable that time limitations prevented a more exhaustive exploration of certain avenues uncovered by the new information.

William W. Gallimore

Organization and Competition in the Dairy Industry. Technical Study No. 3.
409 pages. 1966. $1.25.

A DYNAMIC VIEW OF marketing milk and milk products is presented in this study. Following a general discussion, 10 chapters cover fluid milk marketing. Manufacturing milk and derived products are considered under each of five product groups. Each section is effectively summarized by a brief outlook in which the authors project their findings and impressions.

Bargaining relationships are emphasized in discussing specialization, diversification, integration, private labels, mergers, regulations, transactions between various participants, product differentiation, cooperatives, prices, margins, and profits. Special note is given to the competitive situation existing when one or a few buyers take a very high percentage of a given firm's output. Size disparities among competitors and between different stages in the market are given repeated emphasis.

Economists and sociologists who decry the evils of advertising should find the sections on product differentiation, private labeling, transactions between processors and retailers, trade practices, product development, and advertising most interesting. The reasons for using such practices are reported with greater objectivity than is found in most discussions of the subject.

The authors recognize that the general function of a market system is to provide consumers with the final product while at the same time each decision-making unit is seeking to enhance certain of its interests. These individual participants are pursuing quite varied objectives. Their responses to competitive challenge and changing market conditions are extremely varied. Limiting the competitive response places some firms in an advantageous position at the expense of others.

The study deals with the inadvisability of legislation or regulation designed to maintain

the status quo, to force uniform change, or to unduly restrict competitive strategies. Relationships between sectors of the market are not static. Growth and development proceed at an uneven pace, with first one sector and then another enjoying a relative or competitive advantage. Conditions which result in a differential growth rate are pointed out. Market organization is influenced by governmental activity of all types. Such activity may elevate one group while simultaneously exerting a negative or restraining influence upon others. The authors report favorably upon activities such as grades and standards, uniform health regulations, reciprocity, and other actions by industry and Government which permit milk to be moved more freely between markets.

Despite considerable discussion of cooperatives, the report seems to slight major areas of responsibility exercised by producer cooperatives. Considering its overall impact, the discussion of the Federal milk marketing orders also appears unduly brief for a report of this scope.

The authors of the study are to be commended for their open discussion and presentation of facts concerning market organization and competition in the dairy industry. The strongest aspect of the report is the liberal discussion of "reasons." The authors consider the motivations which bear upon decision makers at different levels, and do not merely list advantages and disadvantages of certain actions or policies. They recognize and present the desirable as well as undesirable aspects of a marketing system which departs from pure competition. In general, adequate consideration is given to the dynamic aspects of the several dairy markets and to conditions which foster changes in competitive relationships.

Market structure is both the cause and effect of changes in production, demand, Government programs, and technology. This technical study succeeds in portraying structure, policy, practice, and technical change as interdependencies, and hence describes the relationships of structure, conduct, and performance more realistically than most past studies. However, the description of the parameters of these relationships in quantitative measures is not very successful.

Case studies of specific fluid milk markets, along with informal interviews with handlers, cooperative leaders, and regulatory officials, enhanced the presentation of the dynamic qualities of individual firms and markets. Otherwise, the massing of data dealing with overall totals--which seems to confuse the actual or potential market structure in any given area--would have destroyed much of the significance of the study.

The largest dairy processors have achieved much of their size through merger and acquisition. Implications of further merger activity and of denying one portion of the industry the right to use this common method of growth are discussed quite ably.

Factors contributing to differential growth rates and abilities to adapt to varying conditions are discussed throughout the report. So, too, are the characteristics which cause competitive pressures to be felt unequally by different organizations. These pressures are especially unequal for plants and firms of different sizes. These discussions definitely are recommended for study by both the economic theoretician and the practitioner, and especially by those charged with regulatory responsibilities.

While the report of the technical study does present new data, the majority of the material is collated from other sources. New data are available from the case studies of six fluid milk markets, a survey of the sales outlets of plants making butter, powder, cheese, and evaporated milk, and a study of intermediate markets for butter, cheese, and powder.

This reviewer appreciates the volume of valuable data presented in tabular form. However, some of the table headings are so incomplete that researchers will experience difficulty in establishing comparability with data from other sources. The methodology reflects lack of sufficient time for exhaustive analysis, as the tabular data are explained in general, informal terms, with a minimum of statistical manipulation.

This study could prove to be most fruitful in generating new research as fertile areas for investigation are conspicuous throughout the report.

Floyd A. Lasley

Organization and Competition in the Fruit and Vegetable Industry. Technical Study No. 4.
392 pages. 1966. $1.25.

IN GENERAL, the report follows a conventional market structure presentation. A good selection of related literature and pertinent statistical series were used to show trends in firm numbers, size, entry and exit, integration, and other industry characteristics. Sources for this information include the Bureau of the Census, Federal Trade Commission, U.S. Department of Agriculture, U.S. Department of Labor, State agricultural experiment stations, and various trade sources. These data were supplemented and updated by a number of special studies conducted by or for the Commission. Although varying in merit, these special studies provide some of the most current information available and, perhaps more importantly, probe some areas that have previously been unavailable to researchers.

One of the major sections of the report is devoted to the fresh fruit and vegetable industry. Results of a Commission study on shipping point markets are presented. Information was obtained from the list of firms contained in a leading trade directory. Most data were analyzed by nine geographic regions and by kinds of plants which included shippers, grower-shippers, buying brokers, selling brokers, buying-selling brokers, and grower-brokers. A possible flaw in the study is that it is based on plant rather than firm data. The justification is that single-plant firms predominate in the industry and that, for multiplant firms, decisions are generally made at the plant level. Nevertheless, other data in the study do not seem to support an analysis based on plants. For example, the study shows that in 1965, although 78 percent of all shipping point firms were single units, 40 percent of the buying brokers and 30 percent of the selling brokers were horizontally integrated. Since brokers had the largest average volume per plant, their impact might be considerable and an analysis based on firms might have produced somewhat different results.

Wholesale terminal markets were the subject of another special study by the Commission. Unfortunately, the large number of markets, the diversity of firm types, and limited time prevented a quantitative analysis. Instead, information was obtained through interviews with management personnel in 44 terminal markets throughout the country. The result is a brief description of the evolution of terminal markets into their present integrated and nonintegrated sectors. Because of this change, it was concluded that price and other data available in these markets have become a less valid representation of supply and demand conditions. While the conclusion is probably correct, the problem of quantifying remains.

In another inquiry, three major Government services were evaluated--market news, grades and standards, and inspection. The survey included 752 shipping point firms and 632 terminal market firms. In addition to the information in Technical Study No. 4, complete details are reported in Supplement No. 2.

The other major section of the report contains five chapters devoted to various phases of the fruit and vegetable processing industry. Canning, freezing, and drying each rate a chapter. Two Commission studies provide most of the data in these chapters. One deals primarily with structure and competitive positions. Market structure researchers will undoubtedly wish the probe had been expanded and had yielded more definite conclusions. The analysis, based on plants rather than firms, may limit the value of some information relating to competitive behavior. The other study provides detailed cost and profit data by industries as well as for nine canned and eight frozen commodities.

Overall, this report is the most comprehensive and up-to-date available in the fruit and vegetable industry. It will undoubtedly be used and quoted by members of the industry for some time to come.

Victor G. Edman

Organization and Competition in the Milling and Baking Industries. Technical Study No. 5.
167 pages. 1966. $0.50.

WITH ITS 123 TABLES and approximately 30 pages of narrative, this work could most accurately be considered a book of statistics rather than an analysis of the milling and baking industries.

The major sources of data are the special surveys. Cost and operating information was obtained from 169 milling plants with daily capacities of 400 hundredweight and over, and from 285 wholesale bakery plants with sales in excess of $1 million in 1963 and 75 percent or more of their total production in white pan bread. Of 56 tables in chapter 2 and appendix A on milling, 49 contain primary data or materials never before made public. Of 60 tables in chapter 3 and appendix B on baking, 50 contain primary data or data never before released. Sources of secondary data for the other tables were largely the Bureau of the Census, the Department of Agriculture, and The Northwestern Miller.

Most of the data are in the form of cross tabulations by size of business, geographic region, and, in the case of wholesale bakeries, type of business organization. Also included are sales-to-assets ratios, averages, and quartile determinations for the milling industry, and a statistical analysis of the main white pan bread formula used by wholesale bakers. The latter shows the weighted and simple averages, standard deviation, and range by quantity of ingredients per hundredweight of flour, price paid per pound of ingredient, and costs of ingredients per hundredweight of bread.

The milling industry was found to be characterized by rapidly declining numbers and low profits. Profits after taxes as a percentage of sales were extremely low, 0.22 percent. Capital investment, after a steady upward trend, has leveled off since 1963. Mills with daily capacities of 5,000 to 7,499 hundredweight had the lowest total unit cost. Cost advantages arising from economies of scale appear to be associated with the size of the milling unit rather than with total plant capacity.

The baking industry was found to be characterized by product proliferation, rising costs, capital outflow since 1961, declining profits, and 80 percent capacity utilization. From 1960 to 1964, costs of selling and distribution increased 1.7 percent while profits declined 27.0 percent. Costs of manufacturing, administration, and selling and distribution favor the medium-size wholesale bakery. Selling and distribution expenses accounted on the average for about 31 percent of the wholesale bread price. However, these costs were about 1 cent a pound greater for large bakeries than for small bakeries and they varied considerably by type of distribution system.

Walter G. Heid, Jr.

Studies of Organization and Competition in Grocery Manufacturing. Technical Study No. 6. 270 pages. 1966. $0.75.

MUCH EXCELLENT information is contained in this well-written report. However, the title is misleading. A brief look at the dry grocery industry, which accounts for about 25 percent of grocery store sales, is presented. But the report is primarily based on detailed studies of the cookie and cracker industry and the breakfast cereal industry.

The major sources of data for the dry grocery industry were published financial statements, trade literature, and a series of studies for the National Commission on Food Marketing by the Grocery Manufacturers of America. Personal interviews were conducted with some of the leading dry grocery manufacturers. This section gives a good insight into the marketing methods in the grocery industry and contributes to public knowledge by synthesizing many individual reports, some of which were not previously available, into a brief but informative statement.

The results indicate that concentration in the grocery industry will probably continue to increase. Success depends largely on a firm's ability to employ effectively the full range of marketing techniques. Small firms will find it increasingly difficult to meet the rising capital requirements. One result in the nonprice competition presently evolving probably will be even more restrictive conditions of entry. Also, continued product innovation and market fragmentation may make private branding less attractive to retailers.

Data for the cookie and cracker industry and breakfast cereal industry were obtained from industry mail questionnaires; personal interviews with the major and selected small manufacturing firms, food brokers, wholesale distributors, and retailers; special tabulations by the Bureau of the Census and the Federal Trade

Commission; material submitted by the Grocery Manufacturers of America and the Cereal Institutes; and published literature.

The analyses of these two industries give the reader an excellent opportunity to study two distinctly different marketing approaches and their effect on each segment of the marketing system. The breakfast cereal industry, with four firms accounting for 85 percent of the market, is characterized by product innovation, extensive product development and market testing, large promotional expenditures, and a highly developed sales and distribution system. The cookie and cracker industry, where the four largest companies account for 62 percent of sales, has just the opposite characteristics. However, profits in both industries are above the average for all food manufacturers.

Although the report is based primarily on only two segments of the grocery industry, the analysis makes it possible to evaluate the other segments with minimal additional information. Masses of detailed information are presented and pertinent relationships are noted and developed.

This study provides much new data and some basis for delineating problem areas and developing means of suggested improvements. However, information gaps such as those in the bread distribution data must be filled before a conclusive industry analysis can be conducted.

Amos D. Jones

Organization and Competition in Food Retailing. Technical Study No. 7.
568 pages. 1966. $1.50.

PART I DOCUMENTS the food retailing industry's patterns of growth (including horizontal, vertical, and conglomerate integration), extent of market concentration, and profit history. It also identifies trends in kinds of available store services and merchandising practices, and explores the extent and sources for obtaining economies of scale. Part II contains a reprint of a contract study conducted by the Federal Trade Commission. Topics treated include conglomerate competitive strategies, trading stamps, and predictions of future structural developments.

Time and monetary constraints forced the Commission staff to stress aggregation and analysis of available data. Thus, while Report No. 7, has 298 tables (excluding supplements), more than half of them contain data previously available. However, many of these tables are presented in a different format or context.

Sources of public information used in the report include the Bureau of the Census, the Federal Trade Commission's Economic Inquiry into Food Marketing, Progressive Grocer, Food Field Reporter, Moody's, and others.

New data came from special studies conducted by the Commission staff, or on behalf of the Commission by other agencies or organizations. The Bureau of Labor Statistics and the Federal Trade Commission contributed extensively to Report No. 7. The Supermarket Institute also contributed new data from its Figure Exchange time series.

Part I contains 193 tables, 87 of which have data previously unavailable to the public. Most of these tables report price or price index information, data relating to the impact of acquisitions in market structure, private label merchandising, economies of scale, profits, price levels, market shares, margins, and changes in costs of retailing.

Part II presents 48 tables. Twenty-four provide data new to most economists as they came from FTC dockets and special studies. These tables show market share ratios, profits, margins, retail store locations, selling prices, invoice costs, and information relating to use of trading stamps. Tables in the appendix supplement text tables.

Much of this report is descriptive. Time series picture the dynamics of structural change. However, the primary analytical thrust concerns five questions: (1) What are the growth patterns of retail stores in local markets? (2) Are there substantial economies of scale in food retailing? (3) Does market share affect pricing practices and retail margins? (4) Does type of firm affect price levels? (5) Do stores of the same company price higher in low-income areas than in high-income areas?

Patterns of growth are handled with a mobility index which shows the percentage of total possible transitions from one size category to another which actually took place. In turn, this net growth change is broken into growth and decline indices,

which show growth and decline as percentages of total possible transitions.

The report compares economies of scale and store utilization. A regression model was adopted to identify effects of variations in utilization and size of facilities upon average total unit cost. This model stated that average cost (in cents per dollar of sales) is some function of square feet of selling area, sales per week per square foot of selling area, wage rates per hour, and degrees of store utilization. A helpful discussion of this model is presented in the appendix (page 493). Tests show that there is surprisingly little intercorrelation between the first two explanatory variables.

Certain stores were omitted from the analysis: those which were over 10 years of age, those which did not operate over 12 months, and those which maintained an unusual balance between departments. The report fails to identify the distribution of store sizes included. The fact that all stores are less than 10 years old suggests the size distribution may cluster in the middle-size categories. If there is fragmentary representation of stores having 4,000 square feet or less, and 16,000 square feet or more, this may partially explain the flatter average total cost slope found for store size than for store utilization.

Results of the Commission's store and market comparisons of operations of large chains and those reported by FTC in its analysis in the National Tea Case present conflicting evidence. In the National Tea Case, 96 percent of the variance associated with net taxable income was accounted for solely by the company's local market share. The Commission's study, however, concluded that "in general, the higher market shares were associated with lower expenses, higher customer purchase, higher sales per store, and per square foot of sales area, lower inventory shrinkage and greater net profit." The report makes no formal effort to explain this conflict of evidence. Thus, further quantitative work appears appropriate.

The BLS study of pricing by stores of the same company in areas of low and high incomes showed no significant differences between areas. It may be argued that the small sample size (18 items) is too fragmentary for the purpose of the study. However, an earlier study conducted by the Department of Agriculture in different communities (which included over 400 items) found analogous results.

Despite its limited time and budget, the Commission staff aggregated an amazing quantity of relevant data. More important, their analyses provide additional insights into the many complex questions confronting the industry. Nevertheless, in spite of the staff's efforts and success, there is little gain in additional consensus with respect to one of the key questions used to justify the creation of the Commission: Have the changes in structure of the food merchandising industry resulted in business practices (particularly pricing) which discriminate against the persons buying from and selling to members of this industry?

Paul E. Nelson

The Structure of Food Manufacturing. Technical Study No. 8.
292 pages. 1966. $1.

THIS REPORT, prepared under contract with the Federal Trade Commission, was published (belatedly) without review by the Food Commission. The only assurance given by the Food Commission was that the data were a significant addition to information about the food industry.

The essential aims, concepts, and methods are Bainsian. The report takes official SIC product and industry classes as the units of inquiry. Shares of leading firms--typically in groups of 4, 8, 20, 50, 100, 200--in sales, value added, value added less payrolls, employment, advertising, assets, and profits are presented for selected postwar years. Conglomerate tendencies are measured. Product differentiation, mergers, market conduct, and profit rates are examined in separate chapters. Census data for 1963 are given for the first time together with some tabulations. Other standard secondary sources (IRS Sourcebook, Moody's Industrials, SEC-FTC Quarterly Financial Reports) and materials from past concentration studies, FTC records, and trade and academic journals, are the grist for the approximately 150 tables and figures, and for the descriptive text.

The major findings are a pronounced increase in concentration, a blunting of competition, and

an increase in monopoly profits. ("About 60 percent of food industry value added is in industries in which the profit analysis of Chapter VI shows substantial monopoly profits," p. 59.) Examination of data on plant scale economies from published studies leads to the conclusion that "economies of scale (except for advertising and promotion activities) are generally insignificant in the food manufacturing industries" (p. 104). Thus postwar concentration in food manufacturing is deemed to be unjustified on efficiency grounds. Disappointingly, no examination is made of other aspects of efficiency that have been discussed by E. A. G. Robinson, Henry Simon, Edith Penrose, Harvey Leibenstein, and others.

Analyses in the study show that the main causes of concentration were mergers and acquisitions. After an acquisition, the advertising outlays for the new products are substantially increased, an action which tends to further seal off competition. Had no mergers occurred within the 50 leading food manufacturing firms between 1950 and 1965, their combined share of industry assets would have decline instead of increased--assuming no stepup of internal growth (p. 120) had occurred (underscoring supplied).

The last chapter develops a special index of concentration for each of 85 leading firms (reflecting each firm's participation as one of the top 4 firms in different product lines in the 1950's). These single-valued measures of company concentration were classified into five classes and the average profit rates on net worth (for 1949-51) were computed for each. The conclusion is that "four-firm concentration in the immediate range of 50 percent appears to be a critical degree above which profits are significantly higher and below which they are significantly lower," (p. 205). Assuming the authors' assertion that concentration cannot be justified on efficiency grounds is correct there is an implication here for antitrust action. However, none is argued.

Of particular value is the collation of many scattered data in one volume, presentation of new data and new classifications, and much detail in the text and footnotes. The quality of the report is uneven, but this is to be expected in a major work carried out under forced draft. Perhaps the chief weaknesses of the study are the limitations of the "structuralist" methods. These include the failure to specify, in satisfactory economic terms, the relevant market boundaries for measuring concentration; the lack of appreciation of the internal organization and functioning of the large firm; the ignoring of the problem of mobilizing capital under uncertainties; and the lack of recognition of the powerful dynamic processes that are part and parcel of the continual enlargement of a market economy. This lack of recognition may well make the issues discussed in the report subsidiary to other phenomena and largely unresolvable in the conceptual framework used. On the other hand, the problems to which the structuralists address themselves are genuine and should not be written off simply because the world is too complex to be handled in their models.

Allen B. Paul

Cost Components of Farm-Retail Price Spreads for Foods. Technical Study No. 9.
55 pages. 1966. $0.25.

THE SMALLEST OF THE 10 technical studies presents detailed information on farm-retail price spreads and component costs and profits for leading farm foods in 1964. It briefly discusses computational methods, problems, and adequacies of the market basket statistics published by the Department of Agriculture. The report brings together data from many sources and explains methodology used to provide estimates of marketing costs which generally have been unavailable in such detail, i.e., by products, agencies, and cost and profit components.

Detailed breakdowns of costs and profits which comprise the farm-retail spreads are presented for 21 individual food items. The margin for each marketing function--retailing, wholesaling, processing, etc.--is broken down into component parts such as labor, supplies, buildings and equipment, and advertising. For example, it cost 21.4 cents to manufacture and distribute butter which retailed for an average of 74.4 cents a pound in 1964. Labor costs including fringe benefits accounted for 31 percent of the farm-retail spread for butter; buildings and

equipment for 19 percent; containers and supplies, other expenses, and profits before taxes each accounted for 11 percent; advertising and promotion for 10 percent; and cartage, vehicles, and other transportation expenses for 7 percent. These cost breakdowns now provide information at the national level that heretofore was available only on isolated bases.

The Commission also presents a breakdown of the instore gross margin for supermarkets into cost components--labor, store supplies, buildings and equipment, advertising and promotion, other expenses, and profits before taxes. A similar breakdown is shown for six major supermarket departments. The Commission used two methods (though not independent) to distribute costs and profits to product groups.

In one method, costs were estimated for each department and profits for each were residual. Thus, profits were high for some departments and low for others, while a loss was estimated for meat. In the second method, it was assumed that stores maximize total profits and neglect individual department profits, in a sort of multiple-price system for food sales. Here all departments received the same percentage of profits and advertising expenditures. The remaining costs in each department were allocated to various cost components on the basis of the percentage distributions estimated in the first method. Data from selected sources were used to estimate particular expenses in individual departments.

The Commission found that retail prices collected by the Bureau of Labor Statistics and used by the Department of Agriculture for computing market basket statistics did not adequately reflect weekend price specials offered by retailers for meats. The report states that in 1964 the USDA farm-retail spreads were overstated for Choice beef, Choice lamb, pork, veal, frying chickens, and turkeys. Revisions in retail prices and spreads to allow fully for specials increased the farmer's share of the consumer's dollar spent for farm foods from 36.7 to 37.7 cents.

The report points out that the effect of these revisions on aggregate food costs and spreads is relatively minor. Therefore, corrections were not large enough either to modify the conclusion that the farmer's share has declined substantially since 1947 or to appreciably alter the upward trends in the retail cost of the market basket and farm-retail spreads. The specific finding that the USDA farm-retail spreads are overstated to the extent indicated should be considered tentative since limited data were used in making the adjustments (e.g., for red meat, data from seven chains in Washington, D.C.). The problem deserves additional study.

The Commission concluded that it is not possible to judge whether the price spread for a particular product is economically justified merely by observing the amount of the spread. Further, it pointed out that breaking down price spreads into component costs and profits is, at most, a small step toward appraising them. It was concluded that "price spreads can be used as a starting point for evaluating the food industry's performance if these questions are asked: (a) Are the functions for which marketing costs are incurred necessary ones? (b) Are the functions efficiently performed? (c) Are profits reasonable? If the answer in each case is 'yes' then the price spread is justified. The questions can be answered only by detailed examination of the industry."

The report emphasizes that the Commission's estimates of cost and profit components of the farm-retail spreads for individual food products and for food product groups were in many instances based on relatively crude data. However, these estimates make a meaningful contribution toward appraising farm-retail spreads and should provide a valuable benchmark for future research.

Henry Badger

Special Studies in Food Marketing. Technical Study No. 10.
229 pages. 1966. $0.65.

UNLIKE THE OTHER nine studies, this report concerns three different subjects.

The first paper, by far the most important as a source of market intelligence for consumers, presents a study of the character and importance of private labeling in the food industry. The primary subject of the study is the degree and nature of competition between manufacturers' brands and retailers' or private brands. It is presented by examining the extent

of private labeling, comparing the retail prices and profitability of the two main types of brands, and studying consumer attitudes toward private labels. Information on the extent of private labeling was obtained from a survey of all retailers with 11 or more stores and all voluntary and cooperative wholesalers, and a sample of independent wholesalers. A total of 579 questionnaires was used. A major finding was that less than 25 percent of total sales were from private brands.

Data on the extent and importance of private label products are based on respondents' estimates of the percentage of total dollar sales for the preceding year, less fresh meat, produce, and products usually defined as nonfoods, that are accounted for by private labels. Estimates were also used to obtain the percentage of the total number of items included in this category which were carried under private label. Questions can always be raised about the accuracy of estimates because most food distributors do not maintain information on dollar sales by major food items. Time limitations, combined with the difficulty of getting responses, appear to have ruled out any attempt to obtain such detailed information. Another limitation is the omission of the private label practices of chains with fewer than 11 stores and single-store operators.

Part II of the private label study develops data on retail pricing, merchandising, and profitability for a group of 13 major product categories. Data on warehouse movements and prices were supplied for divisions or total operations of 11 food chains. Movement data were provided by items during a 12-week period. Information on shelf facings, shelf location, and use of special displays was obtained by observational audits made in a sample of 195 stores covering the 11 chain organizations providing movement data. Despite inherent problems in translating warehouse movement into retail movement, particularly when price specials are involved, this part of the study presents interesting and definitive information on relative prices, margin, profitability, and movement of nationally advertised and private label products in retail organizations having substantial sales. Of particular interest is the manner in which retailers use private label products for price specials. This part of the study provides the best quantitative measure of the comparative performance of nationally advertised and private label products.

Part III of the private label study deals with consumers' attitudes toward private and advertised brands. Information was drawn from two surveys, both involving interviews with a probability sample of the U.S. adult population. One of the surveys, not specifically performed for the Commission, was not confined to food but covered a broad spectrum of consumer goods; it reported women's attitudes toward particular brands. The second survey, however, was directed specifically to learning how a sample of adults felt about various types of brands of food. Apparently, most women do not understand the distinction between private label and national brand products. However, a large percentage of the U.S. adult population thinks that people buy well-known brands because of the belief that they are better.

From a research standpoint, the private label study is undoubtedly the most important paper in Technical Report No. 10. It is difficult to summarize because of the varying qualifications that attach to the findings. However, the author's interpretation and a sizable amount of data do provide new information about an important area of food marketing. Unfortunately, the paper does not attempt to develop information on trends in growth of private label products.

The second paper in Technical Report No. 10 deals with the often-discussed question as to whether food prices are greater in low-income areas than in higher income areas. According to the Bureau of Labor Statistics which conducted the study for the Commission, there are "no significant differences in prices charged by food stores located in low-income areas versus those charged by stores in higher income areas when the same types of stores, the same qualities of foods, and the same size of packages are compared." But small independent stores, which usually charge higher prices, are more common in low-income neighborhoods. Also, patrons in low-income areas tend to purchase certain items in smaller sizes at higher unit costs. The data were gathered from 180 stores--15 in low-income areas and 15 in higher income areas in each of six cities. Eighteen different foods, selected because of their importance in the expenditure pattern, their physical

characteristics, and their inclusion in the Consumer Price Index, were priced. The appearance of the stores, condition of products, credit extended, availability of food stamps, check cashing, and pilferage were also examined.

This study does not provide any significant findings that were not already generally accepted among those knowledgeable in food retailing. It does serve a purpose, however, in providing factual information for those questioning retail practices. It also points out the problem of high costs often associated with food retailing in low-income areas.

The third paper in the report concerns the work of the three agencies responsible for enforcing the major regulatory statutes of the food industry--the Department of Justice, the Federal Trade Commission, and the U.S. Department of Agriculture. This paper provides information on the structure and operation, formal actions, and general statistical information for each agency. The paper concludes with a section on food marketing problems which arise as a result of collateral State regulation. This paper will be of most interest to the nonspecialist. A long listing of actions taken by U.S. agencies is provided for those interested in the historical process of the development of regulation.

Robert E. Frye

Selected Recent Research Publications in Agricultural Economics Issued by the U.S. Department of Agriculture and Cooperatively by the State Universities and Colleges[1]

Allen, George C., and Earl F. Hodges. FEED CONSUMED BY VARIOUS CLASSES OF LIVESTOCK, BY STATES, 1949-50 AND 1959-60, WITH 1964-65 NATIONAL ESTIMATES AND COMPARISONS. U.S. Dept. Agr., Statis. Bul. 379, 56 pp., October 1966.

Consumption of harvested feedstuffs increased 35 percent between the feeding years 1949-50 and 1959-60. This increase continued during the next 5 years, but at only half the rate of the earlier period. Between 1949-50 and 1959-60, silage consumption increased 82 percent; hay, 27 percent; other harvested roughages, 72 percent; and concentrates, 21 percent.

Bowles, Gladys K. THE HIRED FARM WORKING FORCE OF 1965--A STATISTICAL REPORT. U.S. Dept. Agr., Agr. Econ. Rpt. 98, 32 pp., September 1966.

Presents information on the size and composition of the 1965 hired farm working force and on the employment and cash earnings from farm and nonfarm wage work obtained during the year. The data were obtained from the annual survey conducted for the Economic Research Service by the Bureau of the Census as a supplementary part of the regular Current Population Survey made in December 1965.

Christiansen, R. A., and Sydney D. Staniforth. AN INVENTORY OF PRIVATE RECREATIONAL DEVELOPMENTS IN WALWORTH COUNTY. Univ. Wis., Dept. Agr. Econ., Staff Papers Ser. No. 7, 20 pp., July 1966. (U.S. Dept. Agr. cooperating.)

Presents results of an inventory of privately owned recreational facilities recently completed for Walworth County in southeastern Wisconsin. In 1964 the economic value of recreation in Walworth County was exceeded only by farming and manufacturing. Total tourist and recreation spending that year was estimated at a little over $12 million, or at the rate of about $232 per capita.

Clayton, L. Yvonne. HOMEMAKERS' USE OF AND OPINIONS ABOUT SELECTED FRUITS AND FRUIT PRODUCTS. U.S. Dept. Agr., Mktg. Res. Rpt. 765, 82 pp., August 1966.

A nationwide sampling of 2,454 households in late 1963 to early 1964 showed that nearly every household in the United States had purchased fresh noncitrus fruit during the preceding 12 months. Most homemakers generally liked to buy unpackaged or loose fresh fruit. Homemakers were also questioned about their use of applesauce, 9 processed fruits, prunes, and raisins.

Edwards, Geniana R., and Geraldine W. Abbott. THE AGRICULTURAL ECONOMY OF FINLAND. U.S. Dept. Agr., Econ. Res. Serv., ERS-Foreign 169, 32 pp., October 1966.

Agricultural production in Finland has grown steadily during the past decade as a result of expanding crop area and increasing yields per unit of land, livestock, and labor input. Other contributing factors include mechanization and other technological improvements in agriculture as well as agricultural education, research, extension services, and farmers' cooperatives.

Elz, Dieter. EUROPEAN ECONOMIC COMMUNITY IMPORT DEMAND FOR OILSEEDS AND OILSEED PRODUCTS--A SUMMARY. U.S. Dept. Agr., Econ. Res. Serv. and Foreign Agr. Serv., ERS-Foreign 170, 22 pp., November 1966.

By 1970, oilmeal consumption in the European Economic Community is projected to be 55 to 70 percent greater than in 1962-63. About 55 percent of the projected level of oilmeal consumption of 8.2 to 8.8 million metric tons is expected to be soybean meal. In 1962-63, this percentage was 40 percent. The largest share of total projected consumption increases will be used as feed for cattle, poultry, and hogs.

Fox, Austin. DEMAND FOR FARM TRACTORS IN THE UNITED STATES--A REGRESSION ANALYSIS. U.S. Dept. Agr., Agr. Econ. Rpt. 103, 56 pp., November 1966.

In this report, a single-equation regression model is used to explain aggregate tractor horsepower purchases for the United States between 1920 and 1962. Tractor horsepower purchases are expressed as a function of economic, technological, and personal preference variables. These variables include tractor horsepower on hand, crop production, size of new tractors purchased, and age of tractors.

Harris, Edmond S. PRICE WARS IN CITY MILK MARKETS. U.S. Dept. Agr., Agr. Econ. Rpt. 100, 95 pp., October 1966.

Contains an analysis of the competitive processes in city milk markets, and case studies of 23 phases of price warfare in 13 cities. The analysis helps identify the basic conditions of milk marketing which give rise to price wars, while the case studies show the factors which precipitate price wars and the market changes which occur during price warfare.

[1]State publications may be obtained from the issuing agencies of the respective States.

U. S. GOVERNMENT PRINTING OFFICE : 1967 O - 244-772

Hulse, Fred E., Julian R. Meitin, and H. G. Hamilton. POOLING BY FLORIDA CITRUS COOPERATIVES FOLLOWING THE 1962 FREEZE. U.S. Dept. Agr., Mktg. Res. Rpt. 764, 24 pp., July 1966. (Fla. Agr. Expt. Stas. cooperating.)

Conventional pooling arrangements of Florida citrus cooperatives were severely tested during the destructive freeze of December 1962. Changes made in standard cooperative practices during this period raised questions about the fair and equitable treatment of members. Two major objectives of this report were to determine the effect of these changes on organization income and members' equity and the nature of future modifications in pooling arrangements that handle problems in distress situations.

Jordan, Max F., and Lloyd D. Bender. AN ECONOMIC SURVEY OF THE OZARK REGION. U.S. Dept. Agr., Agr. Econ. Rpt. 97, 90 pp., July 1966. (Univ. of Ark. Agr. Expt. Sta. cooperating.)

The shortage of employment opportunities within the 115 counties of the Ozark Region has caused a continued outmigration of youth, population losses, and low incomes. The age composition, insufficient education, and lack of marketable skills of the population tend to retard development of economic activities and to keep workers from moving to areas where jobs are available. The major economic problem in the region is the amount and quality of education.

Knott, Edward M. HOMEMAKERS' OPINIONS ABOUT AND PREFERENCES FOR BROILER-FRYERS AND TURKEYS. U.S. Dept. Agr., Mktg. Res. Rpt. 760, 142 pp., July 1966.

Nationwide samplings showed that 97 percent of homemakers questioned in 1964, compared with 93 percent in 1956, had served broiler-fryers during the preceding year. About three-fourths of the homemakers had served turkey during the preceding year, an increase of 11 percent over 1956. The survey of convenience poultry products showed that about two-thirds of all homemakers had bought one or more of these products in the preceding year.

Michalson, E. L., and I. A. Noteboom. RESOURCE REQUIREMENTS, COSTS, AND EXPECTED RETURNS FOR ALTERNATIVE CROP AND LIVESTOCK ENTERPRISES, PALOUSE WHEAT-PEA AREA. Wash. State Univ., Wash. Agr. Expt. Sta., Bul. 671, 36 pp., September 1966. (U.S. Dept. Agr. cooperating.)

Provides costs, returns, and resource data to farmers, county agents, agricultural researchers, and other decision-makers in order to guide and plan adjustments in crop rotation and livestock enterprises. Although the data apply specifically to the Palouse area, they may be generalized to other areas that have similar crop yields, rotations, and practices.

Miklius, W. COMPARISON OF FOR-HIRE MOTOR CARRIERS OPERATING UNDER THE AGRICULTURAL EXEMPTION WITH REGULATED MOTOR CARRIERS. U.S. Dept. Agr., Mktg. Res. Rpt. 769, 20 pp., August 1966.

According to the 1963 Census of Transportation, exempt motor carriers operated an estimated 30,483 motor vehicles in interstate hauls. Only 4.4 percent of for-hire trucks used in the United States were operated under the agricultural exemption. No significant differences were found between exempt and regulated carriers with respect to model year and lifetime mileages of truck-tractors.

Rapton, Avra. SEASONAL WORK PATTERNS OF THE HIRED FARM WORKING FORCE OF 1964. U.S. Dept. Agr., Agr. Econ. Rpt. 102, 32 pp., October 1966.

Of all American industries, agriculture provides the least stable employment for its hired workers during the year. Employment of hired farmworkers in 1964 ranged from a low of 800,000 in the early part of the year to a peak of 1.9 million during the summer. The highest number employed in a month was 1 1/2 times the average monthly employment for the entire year. Fluctuations in the year's employment were generally related to the characteristics of the workers and to the regional demand for hired labor.

Skinner, Snider W. SENEGAL'S AGRICULTURAL ECONOMY IN BRIEF. U.S. Dept. Agr., Econ. Res. Serv., ERS-Foreign 166, 12 pp., August 1966.

Reviews the trade, agriculture, and general economy of Senegal since the country gained its independence from France in 1960. The report also tabulates production of the country's principal crops: Peanuts, sorghum, millet, cassava, rice, vegetables, sweetpotatoes, corn, cowpeas, mangoes, and citrus fruits. Peanuts and peanut products make up over three-fourths of Senegal's total exports.

Spurlock, Hughes H. THE COMPETITIVE POSITION OF U.S. FARM PRODUCTS IN THE JAPANESE MARKET. U.S. Dept. Agr., Foreign Agr. Econ. Rpt. 32, 117 pp., November 1966.

The United States holds a strong position in Japan's rapidly expanding farm market. Although competition is keen, Japan promises to become the first $1 billion outlet for U.S. farm products. Of Japan's nearly $2.7 billion farm import bill in 1964, the United States supplied $820 million, 31 percent of the total. Purchases from the United States increased 19 percent over 1963.

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